

Economic Risk Management of Civil Aviation in the Context of Ensuring Sustainable Development of the National Economy

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Annotation. Aviation security is an important component of the concept of general national security, the system of personal security, public safety and transport safety from external and internal threats. Maintaining an acceptable level of national aviation safety is a priority for the industry. Economic security is very important in the context of globalization. The main tool for ensuring these tasks is proactive risk management. The development of economic risk management tools is relevant for sustainable development of both the industry of civil aviation in particular, and in the state economy as a whole.

Key words: economic security, proactive civil aviation risk management, sustainable development of the national economy.

1. THE ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS.

The publications of Y.M. Kharazishvili cover tools for maintaining national economic sustainable development security system [1, 24].

The ongoing systematic research on the development of advanced risk management of aviation safety management system is conducted by specialists of the International Civil Aviation Organization (ICAO) [2 – 6, 25], the International Air Transport Association (IATA) [19], the Airport Council International (ACI) [25], the Civil Air Navigation Organization (CANSO) [25], the International Coordinating Council of Aerospace Industries Associations (ICCAIA) [25], the Air Transport Action Group (ATAG) [25], the European Aviation Safety Agency (EASA) [7, 8], the European Civil Aviation Conference (ECAC) [9, 10], the European Agency for Air Navigation Safety (EUROCONTROL) [11] and other world and regional organizations in the field of civil aviation.

Leading manufacturers in the aviation industry, such as Boeing [12] and Airbus [13], make a significant contribution to the process of analyzing integrated aviation safety and forecasting the air transportation market. Periodic monitoring of the national aviation safety & security system is carried out by the Ministry of Infrastructure [27] and the Civil Aviation Authorities (CAA) of Ukraine [26].

The publications of national and foreign scientists are devoted to the study of economic and technological development of air transport and airports of Ukraine and the world. Among them are such as O.V. Arefieva, T.A. Gabrielova, E.V. Kostromina, Yu.F. Kulaev, N. E. Polyanskaia.

The article is a logical continuation of a number of publications on the development of advanced risk management of the aviation safety management system of Ukrainian scientists (D. Bugayko [14-16, 24], V. Kharchenko [14, 16, 21], A. Antonova [16], M. Hryhorak [16], O. Lishchynsky [15], N. Sokolova [15]), as well as Polish scientists (M. Paweska [16], Z. Zamiar [15]) and many researches from other countries of the world. The unresolved part of the research is to highlight the theoretical foundations of aviation economic security management in the context of ensuring the sustainable development of the national economy. The proposed article is devoted to solving this problem.

The goal of the article is to determine the tools for proactive economic risks management of civil aviation in order to introduce effective tools for sustainable development of the national economy.

2. CIVIL AVIATION ECONOMIC DEVELOPMENT PLANNING.

Civil aviation economic development planning is one of the priorities for the strategic management system of aviation safety in the context of ensuring the sustainable development of the national economy. Only cost-effective civil aviation can be safe and secure.

In 2019, there were 1,303 scheduled airlines in the world. They operated more than 31,717 aircrafts, using the infrastructure system of 3,759 airports, with the support of 170 air navigation service providers.

Direct effects. The aviation industry is a powerful catalyst for the economic activity, the creation of new jobs in airlines, airports and air navigation service providers, which directly serve passengers. Aviation also directly creates jobs in the manufacturing sector (these are companies that produce aircrafts, engines and other vital technologies). Contemporary transport serves 4.3 billion passengers and 58 million tons, the aviation industry created 10.2 million direct jobs and added 704.4 billion USD to the world GDP. Aviation is a highly productive industry, measured in terms of GDP per employee (69,000 USD per employee per year), which is about three and a half times the average for the world economy as a whole. Air transport workers must be highly qualified, have developed competencies and sound practical experience [7].

Indirect effects. The economic benefits of aviation extend far beyond direct impacts. Indirect impacts include employment and economic activity of aviation suppliers: aviation fuel suppliers; construction companies; suppliers of aircraft components and equipment; organizations in the non-aviation sector of airports and the business sector. There are almost 11 million aviation-related indirect jobs worldwide. These indirect jobs were about \$ 638 billion. USD in global economic activity [7].

Induced effects. Expenditures of those who are directly or indirectly employed in the aviation sector and, at the same time, maintain additional jobs in other sectors. Nearly eight million jobs created are supported worldwide through aviation workers. The induced contribution of aviation to global economic activity is estimated at 454 billion USD. [7]. The main economic indicators of world civil aviation are shown in Table 1.

Table 1. Analysis of operating, net economic results and variance of scheduled airlines of ICAO member countries (the period from 2009 to 2018) [17]

Year	Operating revenues USD (millions)	Operating expenses USD (millions)	Operating result		Net result ²	
			Amount USD (millions)	Percentage Of operating revenues	Amount USD (millions)	Percentage Of operating revenues
2009	475,800	473,900	1,900	0.4	-4,600	-1.0
2010	563,500	535,900	27,600	4.9	17,300	3.1
2011	642,300	622,500	19,800	3.1	8,300	1.3
2012	705,500	687,100	18,400	2.6	9,200	1.3
2013	720,200	694,900	25,300	3.5	18,100	2.5
2014	766,900	725,200	41,700	5.4	17,300	2.3
2015	720,500	660,700	59,800	8.3	37,500	5.2
2016	709,000	643,800	65,200	9.2	35,600	5.0
2017 ⁽³⁾	757,600	697,900	59,700	7.9	40,100	5.3
2018 ^(3,4)	814,200	763,300	50,900	6.3	33,400	4.1

Source: The World of Air Transport in 2018, ICAO - <https://www.icao.int/annual-report-2018/Pages/the-world-of-air-transport-in-2018.aspx>.

The dynamics of growth of the commercial air transport fleet of ICAO member states in the period from 2009 to 2018 is shown in Table 2.

Table 2. Commercial air transport fleet of ICAO member states (the period from 2009 to 2018) [17].

Year	Turbojet		Turboprop		Total aircraft All types
	Number	Percentage	Number	Percentage	
2009	20 332	87.4	2 932	12.6	23 264
2010	20 904	87.5	2 976	12.5	23 880
2011	21 543	87.7	3 009	12.3	24 552
2012	22 255	88.1	2 997	11.9	25 252
2013	22 893	88.2	3 061	11.8	25 954
2014	23 587	88.5	3 066	11.5	26 653
2015	24 259	88.7	3 093	11.3	27 352
2016	25 060	88.9	3 117	11.1	28 177
2017	26 100	89.3	3 136	10.7	29 236
2018	27 183	89.5	3 196	10.5	30 379

Source: The World of Air Transport in 2018, ICAO - <https://www.icao.int/annual-report-2018/Pages/the-world-of-air-transport-in-2018.aspx>.

3. UKRAINIAN CIVIL AVIATION ECONOMIC DEVELOPMENT PLANNING.

Ukraine is an aviation country, as one of the eight countries, which has a full cycle of development and serial production of aircraft, commercial operation of civil aviation, training and retraining of professionals for the industry. Statistical data on the activities of the aviation industry of Ukraine in the period from 2010 to 2018 indicate its stable development. Today, 34 domestic airlines carry passengers, cargo and mail. The share of aviation in export-import operations of the country which makes accordingly exports - 1221610,7 thousands USD (21% of total exports of transport services) (see Table 3) and imports - 695720,1 thousands USD (48% of total imports of transport services) (see Table 4) [18, 20].

Table 3. Export of transport services and air transport services [18]

(thousands USD)

	2010	2014	2015	2016	2017	2018
Transport services	7835176,2	6101923,5	5263155,3	5300545,6	5861405,6	5851423,3
Air transport services	1181929,8	1071262,5	853618,5	882840,3	1091775,1	1221610,7

Source: State Statistics Service of Ukraine Edited by I. Petrenko. Transport and Communications of Ukraine 2018. Statistical collection. ISBN 978-617-7551-10-1 State Statistics Service of Ukraine, Kyiv - 2019 - 154 p.

Table 4. Import of transport services and air transport services [18]

(thousands USD)

	2010	2014	2015	2016	2017	2018
Transport services	1178914,9	1376552,3	1153393,5	989274,8	1213073,6	1464807,2
Air transport services	447611,9	431037,6	466937,6	357465,0	452397,3	695720,1

State Statistics Service of Ukraine Edited by I. Petrenko. Transport and Communications of Ukraine 2018. Statistical collection. ISBN 978-617-7551-10-1 State Statistics Service of Ukraine, Kyiv - 2019 - 154 p.

Civil aviation is an effective catalyst for investment. Thus, only for the last 5 years (2014-2018), even under conditions of political instability and war in Eastern Ukraine, UAH 4,503.6 million was attracted to the industry.

Table 5. Capital investments of enterprises of economic activities "Transport, warehousing, postal and courier activities" and air transport (period 2010-2018) [18].

Million UAH

	2010	2014	2015	2016	2017	2018
Transport services	19591,7	15498,2	18704,0	25107,8	37943,5	50078,3
Air transport services	616,9	410,2	647,8	616,1	1302,5	1527,7

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4. GLOBAL TRENDS IN AVIATION INFRASTRUCTURE DEVELOPMENT.

In 2018, airlines worldwide carried about 4.3 billion passengers, registering 8.3 trillion commercial passenger-kilometers (RPK). Fifty-eight million tons of cargo was transported by air, reaching 231 billion cargo tonne-kilometers (FTK). Every day, aircraft carry nearly 12 million passengers and goods worth about \$ 18 billion on more than 100,000 flights. Statistics of world international and domestic air traffic in 2009 - 2018 are given in Table 6 [17].

Table 6. Statistics of world international and domestic air transportation in 2009 – 2018[17].

Year	Passengers		Passenger-km		Freight tonnes		Freight tonne-km		Mail tonne-km		Revenue tonne-km	
	(millions)	Annual increase %	(millions)	Annual increase %	(millions)	Annual increase %	(millions)	Annual increase %	(millions)	Annual increase %	(millions)	Annual increase %
2009	2 488	-0.4	4 561 413	-1.1	40.0	-0.8	155 819	-8.9	4 620	-5.5	577 747	-4.3
2010	2 705	8.7	4 924 229	8.0	47.6	19.2	186 631	19.8	4 855	5.1	645 596	11.7
2011	2 870	6.1	5 248 140	6.6	48.7	2.2	187 191	0.3	5 006	3.1	677 631	5.0
2012	3 004	4.6	5 528 880	5.3	48.0	-1.4	185 239	-1.0	5 195	3.8	701 269	3.5
2013	3 138	4.5	5 832 564	5.5	49.1	2.3	185 975	0.4	5 586	7.5	731 033	4.2
2014	3 316	5.7	6 181 177	6.0	50.7	3.3	194 633	4.7	6 076	8.8	773 895	5.9
2015	3 556	7.2	6 644 666	7.5	51.0	0.5	197 131	1.3	6 549	7.8	821 174	6.1
2016	3 794	6.7	7 135 773	7.4	52.8	3.7	204 187	3.6	6 681	2.0	871 639	6.1
2017	4 062	7.1	7 707 118	8.0	56.6	7.1	222 996	9.2	7 449	11.5	945 904	8.5
2018	4 322	6.4	8 257 635	7.1	58.0	2.4	230 967	3.6	7 393	-0.7	1 004 763	6.2

Source: — ICAO Air Transport Reporting Form A and A-S plus ICAO estimates.

Source: The World of Air Transport in 2018, ICAO - <https://www.icao.int/annual-report-2018/Pages/the-world-of-air-transport-in-2018.aspx>.

Civil aviation statistics suggest that the growth of basic air traffic doubles every fifteen years, which is much more dynamic than the growth of most other industries. Since 1960, the demand for passenger, luggage, freight and mail has been steadily increasing. The development of technological progress and related investments are combined and make it possible to multiply the output of the aviation industry by a factor of more than 30. This expansion of air transport is extremely beneficial for the growth of the world economy, primarily for world production (global GDP), when measured in real terms, multiplied more than five times over the same period.

However, a structural analysis of air traffic volumes suggests that the dynamic growth of air traffic is consistently opposed by recession cycles. The aviation industry is an open system that is affected by a wide range of technical, natural, human and economic threats. For its part, it itself is a generator of significant threats to the environment. Among the most significant threats to civil aviation in the history of development are the fuel crisis (1973), the Iran-Iraq war (1981), the Gulf War (1991), the Asian crisis (1997-98), and the 9/11 terrorist attack, SARS pandemic (2003), global recession (2008) [7].

The civil aviation industry systematically opposes these negative trends and is itself one of the most effective tools for overcoming them. Figure 1 shows the evolution of global air transport, taking into account external threats and the impact of their negative factors.

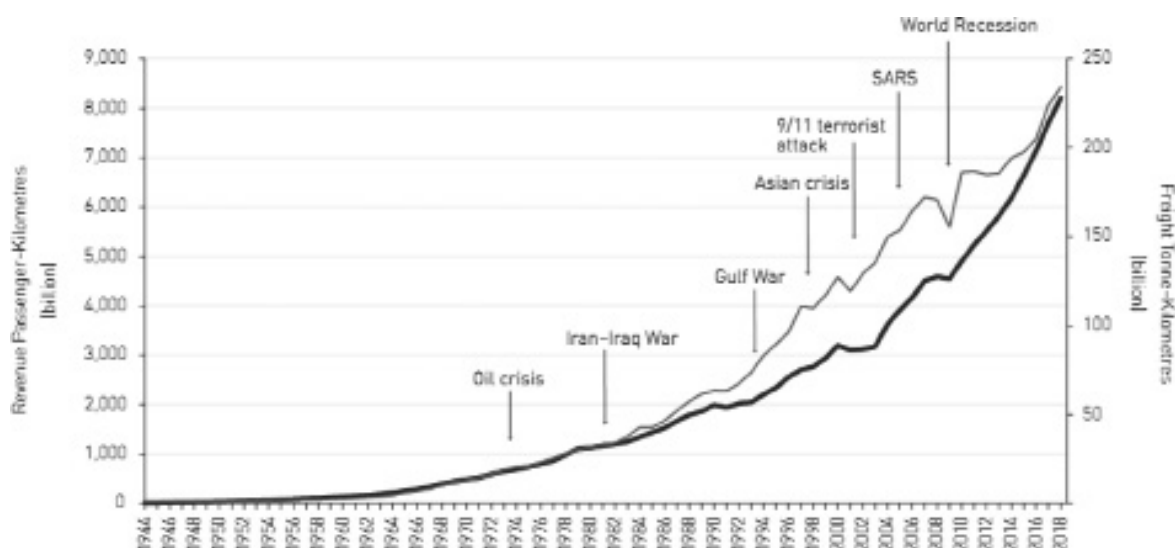


Figure 1. Evolution of the development of world air transportation taking into account the impact of the fuel crisis (1973), the Iran-Iraq war (1981), the Gulf War (1991), the Asian crisis (1997-98), the terrorist attack 9/11 (2001), SARS (2003), the global recession (2008) [25].

Source: Aviation Benefits Report 2019, ICAO (Report based on material of ACI, CANSO, IATA, ICAO, ICCAIA, ATAG)

5. GLOBAL AVIATION MARKET FORECASTS AND UNPREDICTABLE IMPACT OF COVID 19 PANDEMIC.

In 2019, Airbus Industry specialists prepared an optimistic forecast for further traffic growth, which correlates with ICAO's forecasts and operates with an expected growth of air traffic - 4.3% per year. The results of Airbus Global Market Forecast (2019 - 2038) are shown in Figure 3 [13].



Figure 2. Airbus Global Market Forecast (2019 - 2038) [13].

Source: Airbus Global Market Forecast / Cities, Airlines & Aircraft, 2019–2038.

Until March 2020, these predictions were practically not in doubt among researchers. However, the negative factor of the COVID 19 pandemic, as well as the low level of predictability of the level of its further spread and the effectiveness of the countermeasures, will definitely lead to serious adjustments to the optimistic forecast data.

However, one of the most threatening challenges in the history of aviation is the spread of a new deadly coronavirus infection, COVID 19, which effectively leads to a quarantine blockade of entire regions, and a sharp reduction or even ban on air travel. Demand for air travel has declined sharply due to the spread of the coronavirus and flight restrictions in many countries. This creates big problems not only for air carriers, but also for aircraft manufacturers and their suppliers.

The world's airlines are even preparing for a possible voluntary termination of almost all international and domestic flights due to declining demand. In total, according to preliminary forecasts of the International Air Transport Association (IATA), airlines could lose more than \$ 250 billion due to the pandemic. In this case, their revenue will fall by more than 40% in 2020. Sydney consulting company CAPA is even more pessimistic. It predicts that the coronavirus pandemic could lead to the bankruptcy of most airlines around the world by the end of May if the authorities refuse to agree on steps to avoid such a situation [19].

6. UKRAINIAN AVIATION INFRASTRUCTURE DEVELOPMENT: PASSENGER AIR TRANSPORTATIONS.

Statistics on the activities of the aviation industry of Ukraine (2010 – 2019) indicate its stable development. During 2019, passenger and cargo transportation was performed by 29 domestic airlines, which performed a total of 103.3 thousand commercial flights (in 2018 - 100.2 thousand flights). The main production indicators of passenger air transportation are given in Table. 8 and 9 [18, 20, 26].

Table 8. Air transportation of passengers and passenger turnover of Ukraine [18]

	2010	2014	2015	2016	2017	2018	2019
Million passengers	6	6	6	8	9	12	13,6
Passenger turnover (billion passenger-kilometers (RPK))	11	11,6	11,4	15,5	20,4	25,9	30,058

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In 2019 year, the market of passenger air transportation continued to show positive dynamics. According to statistics on the number of passengers who used the services of Ukrainian enterprises, increased by 9.4 percent and amounted to 13705.8 thousand passengers. During the year, passenger traffic operated in 18 domestic air directions. During 2019 year a total of 13,306.7 thousand people were transported.

Table 9. Transportation of passengers by air by type of service [18, 26].

(Thousands of passengers)

	2010	2014	2015	2016	2017	2018	2019
Total	6106,5	6473,3	6302,7	8277,9	10555,6	12529,0	13705,2
International	5144,3	5826,7	5678,0	7475,4	9614,5	11446,1	12547,2
Domestic	962,2	646,6	624,7	802,5	941,1	1082,9	1158

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Also, as at the global level, we see a direct dependence of production indicators on the negative impact of external factors: the annexation of Crimea, the war in eastern Ukraine, the downing of Boeing - 777 "Malaysian Airlines", the closure of airspace over Ukraine, refusal to fly over the Russian Federation has caused a significant decline in passenger traffic.

However, civil aviation is not only an open system, but also an adaptive system. And we can see that these significant recessionary trends have been overcome through the development of infrastructure, taking into account the newly created constraints.

7. UKRAINIAN AVIATION INFRASTRUCTURE DEVELOPMENT: CARGO AIR TRANSPORTATIONS.

In 2109 the volume of cargo and mail by air transport of Ukraine decreased by 6.6 percent and amounted to 92.6 thousand tons. Cargo and mail were transported by 20 domestic airlines. Leaders of cargo transportation are ATP SE Antonov, Ukraine International Airlines (UIA), ZetAvia, Maximus Airlines and Yuzhmashavia.

These airlines in the reporting year performed almost 85 percent of the total volume of cargo and mail. It should be noted that most cargo has traditionally been charter flights to other countries under UN humanitarian and peace programs, as well as under contracts and agreements with other customers. [19, 20, 26].

Table 10. Cargo transportation and cargo turnover on air transport of Ukraine [18].

	2010	2014	2015	2016	2017	2018	2019
Cargo transportation million tons	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cargo turnover (billion tonne-kilometers (FTK))	0.4	0.2	0.2	0.2	0.3	0.3	0.294

Source: State Statistics Service of Ukraine Edited by I. Petrenko. Transport and Communications of Ukraine 2018. Statistical collection. ISBN 978-617-7551-10-1 State Statistics Service of Ukraine, Kyiv - 2019 - 154 p.

8. UKRAINIAN AVIATION INFRASTRUCTURE DEVELOPMENT: AIRPORTS, ATC PROVIDER UKSATSE AND GENERAL AVIATION.

Ukrainian aviation infrastructure development: airports. In total, commercial flights of domestic and foreign airlines in 2019 were served by 19 Ukrainian airports and airfields. The number of aircrafts sent and arrived during the year amounted to 201.2 thousand (against 182.8 thousand in the previous year). At the same time, passenger traffic through the airports of Ukraine increased by 18.4 percent and reached 24334.5 thousand people. Cargo flows increased by 6.7 percent and amounted to 60.2 thousand tons. At the same time, about 98 percent of passenger traffic and almost all mail and cargo flows are concentrated in 7 major airports (Boryspil, Kyiv (Zhulyany), Lviv, Odessa, Kharkiv, Zaporizhia and Dnipropetrovsk). The increase in the number of passengers served compared to 2018 was recorded at the following airports: Kharkiv - by 39.4 percent, Lviv - by 38.8 percent, Boryspil - by 21.1 percent, Dnepropetrovsk - by 13.2 percent, Odessa - by 17, 1 percent and Zaporizhia - by 8.4 percent. At the same time, there was a reduction in passenger traffic at the capital's Kyiv (Zhulyany) airport (by 6.9 percent) [26].

Ukrainian aviation infrastructure development: ATC provider UkSATSE. UkSATSE served 335.4 thousand flights in 2019 year against 300.9 thousand flights in 2018. The number of Ukrainian airplanes and helicopters flights rose on 2.9 percent, and foreign airlines - 16.2 percent.

Ukrainian aviation infrastructure development: general aviation. In 2019, general aviation companies cultivated 360.7 thousand hectares of agricultural land, the raid during aviation work in the economy amounted to 8.8 thousand hours (for 2018 - 569.2 thousand hectares and 11.8 thousand hours, respectively).

9. UKRAINIAN AVIATION MARKET FORECASTS AND UNPREDICTABLE IMPACT OF COVID 19 PANDEMIC.

The Ministry of Infrastructure of Ukraine conducted a forecast of the volume of air passenger traffic in the Ukrainian national segment. The results of the forecast are shown in Figure 3 [27].

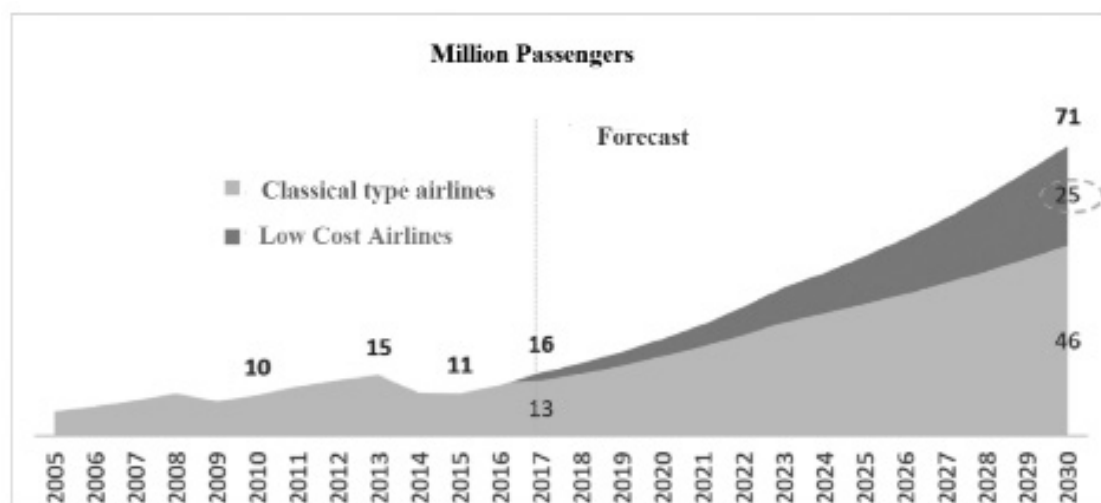


Fig. 3. Air Passenger Traffic Forecast (2018 - 2030) of Ministry of Infrastructure of Ukraine [27].

Source: Official site of Ministry of Infrastructure of Ukraine: <https://mtu.gov.ua/files/lowcost.pdf>

Passenger traffic through the airports of Ukraine by 2030 will increase 4.3 times compared to 2017 - to 71.2 million out of 16.5 million people. Such forecasts have been provided by the Cabinet of Ministers. In addition, by 2030, the share of passenger traffic carried by low-cost airlines is expected to increase to 35% of the total, as well as the reduction of the minimum ticket price to 25-30 euros. In particular, the Ministry of Infrastructure hopes to triple the network of domestic routes, international – to double, and attract air transit cargo through the capital and regional airports of Ukraine [27]. Therefore, the results of the forecast are quite optimistic. However, both globally and nationally in 2020, we are experiencing the negative impact of the COVID 19 pandemic factor, which leads to unpredictable consequences. To corrections of optimistic forecasts of global and national aviation will be devoted to our next scientific works.

Unfortunately, in time when we write this article, we are witnessing the development of one of the world's most serious aviation crises, the spread of COVID 19. Since March 17, the Ukrainian authorities have banned international passenger traffic by both air and land. The air transport economy is extremely vulnerable to external factors, as it has a number of fixed cost items that must be paid regardless of standard or force majeure conditions. First of all, this is the payment of lease payments for the fleet of aircrafts, which now consists mainly of leased aircrafts. Airlines pay an average of 10,000 USD per day for leasing one Boeing 737-800 or Airbus 320.

Thus, the daily leasing budget of UIA can be about \$ 300,000 USD, SkyUp and Wind Roses - up to 100,000 USD. To these costs are added other fixed cost items: staff salaries, insurance, maintenance of airworthiness of aircrafts, and others. Under such conditions, it is anticipatory risk management and consolidation measures by states, aircraft or helicopter operators; approved maintenance organizations; organizations responsible for the design or manufacture of aircraft and leasing organizations; air traffic service providers; operators of certified aerodromes approved by training organizations may interfere with the overall destruction of the industry. Thus, the specificity of open systems is the phenomenon of "domino effect". If organizations of one segment disappear from the market, it systematically affects the performance of other segments, as well as the overall energy of the industry [19].

Unfortunately, the operational statistics of the aviation industry of Ukraine in 2020 allows us to assess the devastating impact of pandemic factors on the work of the industry. Unfortunately, the forecast data for the calendar year 2020 are pessimistic. In January-June 2020, the volume of passenger traffic of Ukrainian airlines decreased compared to the same period last year by 67% and amounted to 2008.9 thousand people, including international - by 67.5% and amounted to 1802.2 thousand people. Passenger traffic through the airports of Ukraine decreased by 61.8% and amounted to 4142.7 thousand people, including in international traffic - by 61.7% and amounted to 3725.9 thousand people. During January-June 2020, Ukrainian airlines performed 19.4 thousand commercial flights (a decrease compared to the same period last year - by 59.4%), including international - 16.2 thousand (reduction - by 59.3%) [26].

10. CONCLUSION

The economic security of the state is an integral characteristic of a set of interconnected structural components of security, which reflect the functioning of certain sectors of the economy: macroeconomic, investment, innovation, financial, social, foreign economic, energy, food, demographic, environmental (about 100 indicators are used). In turn, economic security is a subsystem of the highest level system - national security. This confirms the complexity and versatility of the concept of "economic security" [1,24].

The aviation industry is a part of the transport complex of Ukraine, which is an important component in the structure of the country's economy and a link between all components of economic security to ensure the basic conditions of life and development of the state and society. At first glance, the main task of economic security of aviation is to find adequate answers to the threats identified in the planning of economic development of aviation and in the implementation of measures for the development of aviation infrastructure. And this is a really correct definition, but the assessment of economic threats is an integral part of all the logical blocks of the structural and functional scheme of strategic management of aviation safety in terms of sustainable development of the national economy. Thus, proactive risk management of economic security is the key to maintaining the reliability and sustainable development of the national economy.

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